

## DESCRIPTION OF A NEW SPECIES OF THE *HIRTODROSOPHILA* *LIMBICOSTATA* SPECIES COMPLEX (DIPTERA, DROSOPHILIDAE) BREEDING ON *IMPATIENS* L. FLOWERS

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**Abstract** A new species of the genus *Hirtodrosophila* Duda, 1923 breeding on living flowers of *Impatiens tayemonii* Hayata, 1916 was found from Yunnan, Southwest China. In the present paper, this new species is described in detail, with some of the characters addressed in light of adaptation for special breeding site and larva food habit.

**Key words** *Hirtodrosophila limbicostata* species complex, new species, *Impatiens tayemonii*, Yunnan, China.

Species breeding on flowers are interesting for investigating their adaptation to exclusive microenvironments, for example, adaptation of larvae to the secondary metabolic products of the host plant that likely to be toxic for other species (Brncic, 1983). Most species of the genus *Hirtodrosophila* Duda, 1923 are known as fungivorous, while very few species in this genus have been recorded to feed or breed on flowers. During the recent years, it was observed that two *Hirtodrosophila* species [*H. actinia* (Okada), 1991 and the new species described in this paper] feeding and/or breeding on the flowers of the genus *Impatiens* Linnaeus, 1753 (*Impatiens uniflora* Hayata, 1908 and *I. tayemonii* Hayata, 1916, respectively) (MJ Toda, personal communication). The present paper gives a detailed description of the new species associated with the flower of *I. tayemonii*.

Adult flies of the new *Hirtodrosophila* species resting inside or outside the corolla of *Impatiens tayemonii* Hayata (Fig. 1) were captured using plastic cup, etherized in the cup, and then preserved in 70 % ethanol. Some flower buds were also collected and brought to laboratory, with some were examined for presence or distribution of eggs (Fig. 2) and growing larvae (Fig. 3) within the flower buds under stereomicroscope. Larvae were taken out from the flower buds and treated following the method of Takenaka *et al.* (2006) for morphological observation. Some other flower buds were maintained in glass culture vials (100 mm in height and 30 mm in diameter, with soaked sterilized tissue paper at the bottom, blocked with cotton plug) at 20°C in incubator for further observation of fly pupation (Fig. 4) and eclosion. Adults emerged from flower buds were identified by comparing with those collected in the field.

### *Hirtodrosophila yapingi* sp. nov. (Figs 5–27)

Head (Figs 5–6). Eyes dark purplish brown, with thick interfacetal setulae. Pedicel conical, brown, laterally blackish brown, with two prominent and a few small setae. First flagellomere greyish brown; arista with 2 dorsal and 1 ventral branches besides a fine terminal fork. Palpus yellow, tip rounded, with one prominent apical seta, and a few short apical and ventral setae. Ocellar triangle large, black. Periorbit black. Frons dark brown, nearly parallel-sided, 0.43 as broad as head in holotype [0.43–0.47 in all the 20 (10 ♂♂, 10 ♀♀) paratypes]. Clypeus black. Face brown. Carina narrow, brown. Gena narrow, brown; postgena black. Occiput entirely black. Vibrissa 0.15 (0.13–0.16) mm in length; subvibrissal seta short. Anterior reclinate orbital seta 0.60 (0.54–0.70 in 9 ♂♂ and 9 ♀♀ paratypes) length of posterior reclinate orbital seta; proclinate orbital seta 0.99 (0.90–1.05 in 9 ♂♂ and 7 ♀♀ paratypes) length of posterior reclinate orbital seta.

Thorax (Fig. 6). Scutum black, yellowish brown along suture and longitudinally along dorsocentral setae. Thoracic pleura yellowish to blackish brown. Postpronotal lobe yellow, with 2 prominent setae subequal in length. Scutum blackish brown, yellowish brown laterally and anteriorly. Acrostichal setulae in 8 regular rows. Anterior dorsocentral (DcA) 0.51 (0.47–0.60 in all the 20 paratypes) length of posterior dorsocentral (DcP); distance between ipsilateral dorsocentrals 0.32 (0.30–0.40) cross distance between anterior dorsocentrals. Anterior scutellar 0.90 (0.90–1.07) length of posterior scutellar; length distance between ipsilateral scutellars 1.15 (0.95–1.29) length of distance between apical scutellars. Anterior katapisternal seta as

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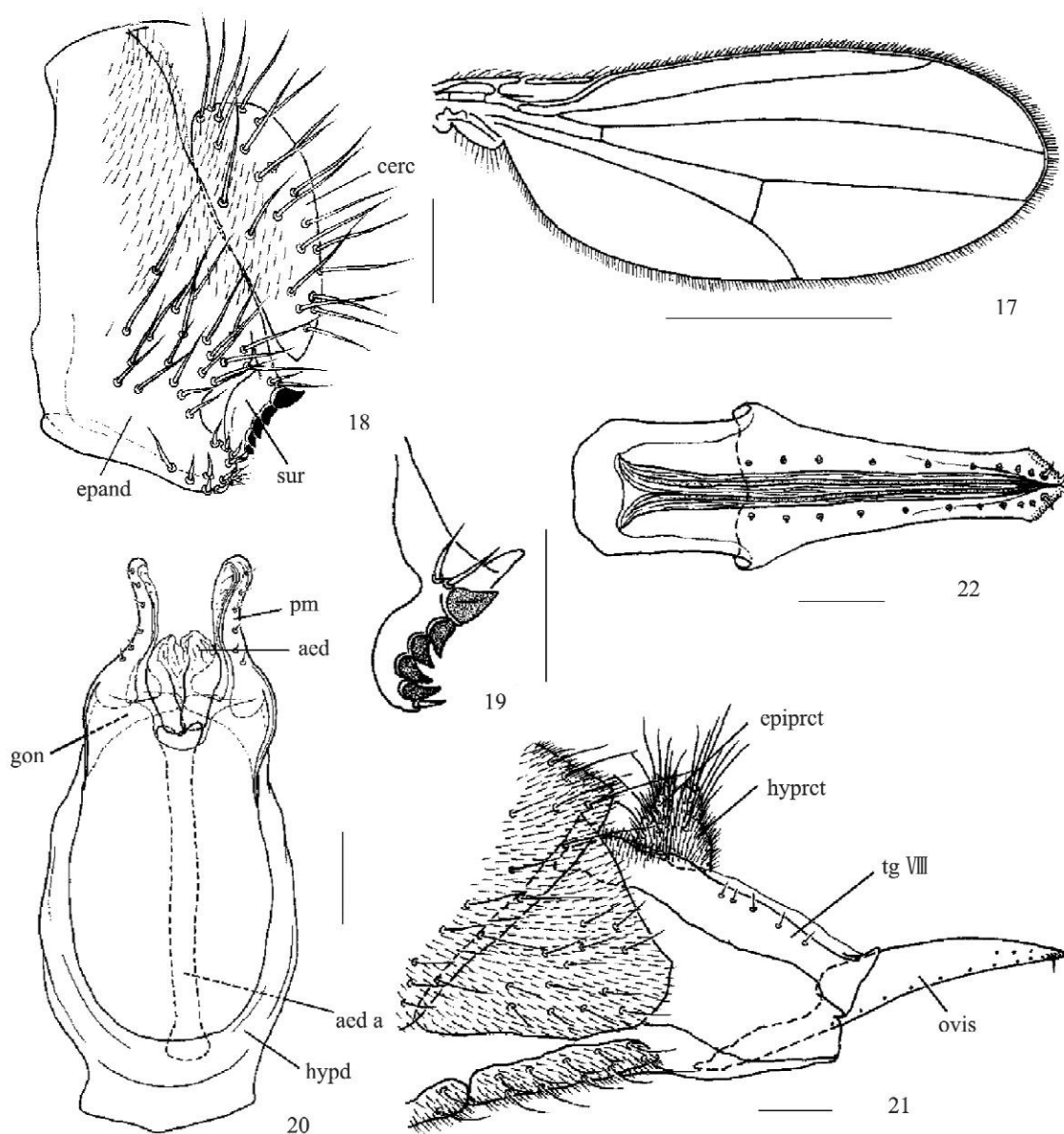
Figs 1 – 16. *Hirtodrosophila yapingi* sp. nov. 1. Adults gathering in- and outside the corolla of *I. tayemonii* flower. 2. An egg laid on the surface of the anthers of *I. tayemonii* flower bud. 3. Newly hatched larva digging the anther of *I. tayemonii* flower bud. 4. Pupae found in tissue paper in glass culture vials in laboratory. 5. Male head (lateral view). 6. Male head and thorax (dorsal view). 7. Mid leg showing dark spines on tarsal segments. 8. Male abdomen (dorsal view). 9. Peripheral organs (poster view). 10. Phallic organ (lateral view). 11. Decasternum (posteroventral view). 12. Ejaculatory apodeme (lateral view). 13. Ejaculatory apodeme (ventral view). 14. Apical part of oviscapt (lateral view). 15. Apical part of oviscapt (ventral view). 16. Spermatheca. Scale bars: 9 – 11, 14 – 16 = 0.05 mm, 12 – 13 = 0.025 mm.

long as the median one, but 0.72 (0.63 – 0.81) length of the posterior one.

Wing (Fig. 17). Pale brown, tip rounded, with long setulae along the whole margin. Veins brown,  $R_{2+3}$  apically slightly curved to costa,  $R_{4+5}$  and  $M_1$  apically slightly converged. Wing indices:  $C = 2.43$  (2.31 – 2.66 in 20 paratypes),  $4V = 1.58$  (1.48 – 1.74),  $4C = 0.84$  (0.78 – 0.95),  $5x = 1.61$  (1.43

– 1.91),  $Ac = 2.62$  (2.44 – 2.83),  $m = 0.27$  (0.25 – 0.30). Costal strong setation slightly exceeding tip of  $R_{2+3}$ , present in the 3rd costal section as a very short, sparse row about 0.27 (0.04 – 0.29) length of the whole section.  $C_1$  setae two, subequal. Halteres pale yellow.

Legs yellowish brown, last tarsal segment dark, claw large; mid and hind leg tarsal segments each with



Figs 17 – 22. *Hirtodrosophila yapingi* sp. nov., male (holotype) and female (paratype) from Bamboo Temple, Kunming. 17. Wing. 18. Periphallitic organs (posterolateral view). 19. Surstylus (posterolateral view). 20. Phallic organs (ventral view). 21. Female terminalia (lateral view). 22. Oviscapt (ventral view). Abbreviations: epand, epandrium; cerc, cercus; pm, paramere; aed, aedeagus; gon, gonopod; aed a, aedeagus apodeme; tg VIII, abdominal tergite VIII; ovis, oviscapt; epiprct, epiproct; hyprct, hypoproct. Scale bars: 17 = 1.0 mm, 18 – 20 = 0.05 mm, 21 – 22 = 0.1 mm.

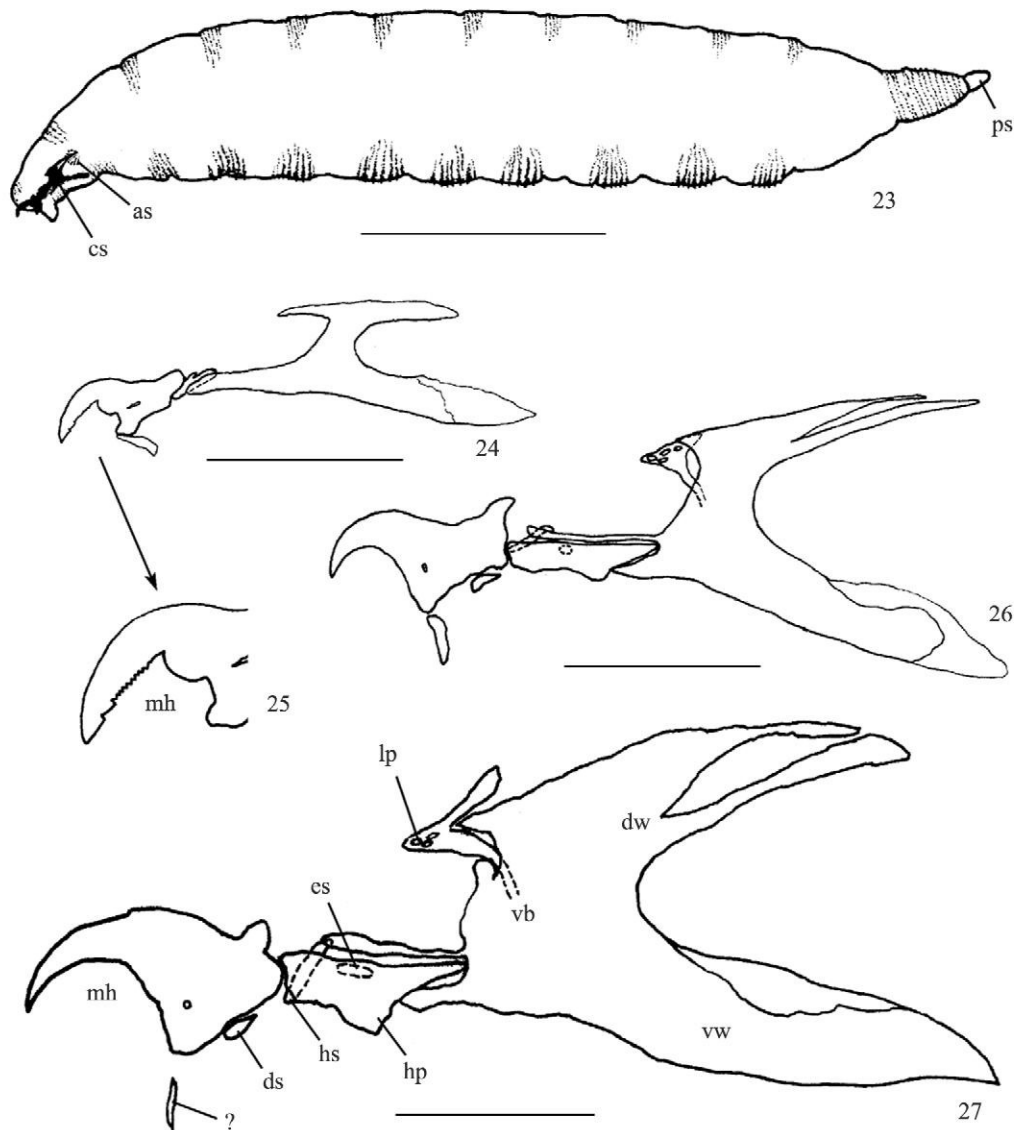
a pair of short, dark spines apically (Fig. 7). Preapicals present on all legs, apicals present on mid legs only. Lengths of fore, mid and hind metatarsi in a ratio of *ca.* 1.0:1.2:1.7.

Abdomen (Fig. 8). Tergites dark brown, with broad pale bands at base of each tergite, interrupted by a dark vitta on tergites 3 – 5 (Fig. 7). Abdominal sternites greyish yellow.

Male terminalia (Figs 9 – 13, 18 – 20). Epandrium brown, broader below, caudally pubescent from dorsal to lateral part; lower half of epandrium broader, truncated below, with 21 long setae at upper

portion and 16 short setae on caudo-ventral portion. Surstylus brown, with 5 dark brown, canine-like prensisetae ranged in a rough row, dorso-caudal corner with 2 long, somewhat thick setae, lowermost with 1 peg-like prensiseta. Dorso-caudal portion of two surstyli curved inward, apically convergent to each other and fused to decasternum. Cercus brown, semilunar, ventrally pointed, pubescent anteriorly, with 22 setae. Aedeagus dark brown, short, articulated with apodeme; lateral plates sclerotized, apically membranous, indistinguishable from median membrane; Aedeagus apodeme much longer than





Figs 23 – 27. *Hirtodrosophila yapingi* sp. nov., larvae ex flower buds of *Impatiens tayemonii* Hayata from Kunming. 23. Third instar larva (lateral view). 24 – 25. Cephalopharyngeal skeleton of first instar larva (lateral view). 26. Cephalopharyngeal skeleton of second instar larva (lateral view). 27. Cephalopharyngeal skeleton of third instar larva (lateral view). Abbreviations: as, anterior spiracle; cs, cephalopharyngeal skeleton; ds, dental sclerite; es, epipharyngeal sclerite; hp, hypostomal sclerite; hs, hypopharyngeal sclerite; lp, latticed process; mh, mouth hook; ps, posterior spiracle; vb, vertical bridge of pharyngeal sclerite; vw, ventral wing of pharyngeal sclerite. Scale bars: 23 = 1.0 mm, 24 – 27 = 0.1 mm.

aedeagus, but shorter than hypandrium, apically expanded in lateral view. Paramere brown, finger-like, apically curved upwards and outwards, longer than aedeagus, with ca. 6 minute sensilla arranged longitudinally on subapical to basal portion. Gonopods broadly fused to paramere, apically close to each other, forming a dorsal arch. Hypandrium brown, without paramedian seta. Decasternum oblong, moderately sclerotized, fused to the dorsal tip of the dorsal arch. Ejaculatory apodeme plate pale, spade-shaped, less sclerotized, laterally with 3 – 4 pits; stalker brown, median part with short process.

Female terminalia (Figs 14 – 16, 21 – 22).

Abdominal tergite VIII blackish brown dorsally, ventrally paler, attached to oviscapt; lateral portion with six tiny setae in a rough row. Oviscapt bent downwards, horn-shaped in lateral view; valves conspicuously bent inwards at tip, each apically with a tight row of tiny processes, in addition to ca. marginal and ca. 3 lateral ovisensilla, and a fine subterminal trichoid seta. Spermatheca blackish brown, hemispherical, dome-shaped in lateral view; introvert ca. 1/2 height of out capsule.

Measurements. Body length = 1.97 mm (1.86 – 2.24 mm in 10 ♂♂ paratypes, 2.18 – 2.82 mm in 10 ♀♀ paratypes). Thorax length including scutellum

= 1.00 mm (0.94 – 1.17 mm in 10 ♂♂ paratypes, 1.09 – 1.19 mm in 10 ♀♀ paratypes).

Holotype ♂, China, Bamboo Temple, Kunming, Yunnan; *ex.* flower of *Impatiens tayemonii* in deep, wooded valley with stream running along its bottom; 22 Aug. 2006, *ca.* alt. 1 950 m, by Toda M. J. and GAO Jian-Jun (KIZ: Kunming Institute of Zoology, Chinese Academy of Sciences, Kunming, China). Paratypes, China (Kunming, Yunnan): 7 ♂♂, 6 ♀♀, same date as the holotype; 3 ♂♂, 3 ♀♀, same data as the holotype, except for 20 Aug. 2006; 1 ♀, same data as the holotype, except for 16 Sep. 2007, by GAO Jian-Jun (KIZ; SEHU: Systematic Entomology, Hokkaido University of Museum, Sapporo, Japan; NHM: the Natural History Museum, London).

Larva (Figs 23 – 27). Body surface with fine spicules; caudal abdominal segments with very fine spicules, apically with a pair of short posterior spiracles. Mouth hook shorter than dorsal wing of pharyngeal sclerite, ventrally dentate in the first, but not the 2nd and 3rd instars larvae; latticed process of pharyngeal sclerite laterally connected to the inside surface of dorsal wings.

Eggs, all lacking chorionic filaments, were laid in the slot between anthers, which are still developing (light green in color and somewhat transparent, comparing to the developed ones, which are yellow and opaque). Egg was much less seen in flower buds than larva, probably due to that they were not laid until well-developed, and thus hatched soon after laying. Usually only one or two larvae were found in a single flower bud. Once two larvae were found in the same flower bud, they are usually distinct in body size, indicates that female of *H. yapingi* sp. nov. usually lays one egg at a time.

The observation of the presences of eggs and growing larvae in the flower buds reveals that *H. yapingi* sp. nov. utilizes the living (instead of decaying) flowers of *I. tayemonii*. The ovipositor of the female of the new species is strongly sclerotized, with valves forms a spear-like tip which is acuminate in lateral view, each with a tight row of processes. All these characters are presumably adaptations for laying eggs within the flower buds. Scars on the surface of a few flower buds have been observed, and eggs found in the same flower bud under microscope in laboratory.

According to my observation, pollen of *I. tayemonii* should serve as the main food for the larvae of the new species. It is notable that only the first instar

larvae of this fly species has dentation on mouth hook, which may due to that the first instar larvae is too small to gulp the pollen grains. The flower may serve as sites for adult gathering and ovipositing, and for larva growing, whereas so far, the pupating site of the larvae in the field and the food habits of the adults of the new species are still unclear, though pupation on the out surface of flower, in tissue paper and the inner wall of glass vials has been observed in laboratory.

Distribution. China (Yunnan).

Remarks. The new species resembles *H. limbicostata* (Okada, 1966) of the *H. hirticornis* species group. They differ from each other in the abdominal markings and in the shape of the ovipositor. In the new species, the female abdomen shows broad pale bands at the base of each tergite, interrupted by a dark vitta on tergites 3 and 4, while in *H. limbicostata*, the female abdomen is predominantly dark brown, with a pale central marking at the base of each tergite, forming an interrupted pale stripe down the middle of the abdomen, and moreover, there are also small and less conspicuous pale areas near the basal corners of the abdominal tergites. In addition, females of the new species have clearly narrower ovipositor (especially on the apical half), with the ovipositor valves not bent inwards at the tip, while in *H. limbicostata*, the ovipositor is much more broadened, and the ovipositor valves conspicuously bent inwards at the tip.

Etymology. Patronym, in honor of Prof. ZHANG Ya-Ping at Kunming Institute of Zoology, Chinese Academy of Sciences.

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## 繁殖于凤仙花上的缘毛果蝇种复合一新种记述（双翅目，果蝇科）

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**摘 要** 记述了采自云南昆明的毛果蝇属缘毛果蝇种复合 1 新种：亚平毛果蝇 *Hirtodrosophila yapingi* sp. nov.。研究标本收藏于中国科学院昆明动物研究所标本馆、北海道大学博物馆及英国国家自然历史博物馆。

**亚平毛果蝇，新种** *Hirtodrosophila yapingi* sp. nov. (图 1 ~ 27)

新种与报道自尼泊尔和中国云南的缘毛果蝇 *H. limbicostata* (Okada) 1966 相似。两个种的区别在于腹部的斑纹和产卵瓣的形状。新种雌成虫腹部每节背板基部具浅色宽带，在第 3 和第 4 背板上被暗色带遮断；缘毛果蝇雌成虫腹部主要为暗棕色，各节背板基部中央具浅色斑，形成向腹中

部下行的、中断的浅色纵带，并在靠近腹背板基部角处具小的较不明显的浅色区域。此外，新种雌成虫具明显较窄的产卵器（尤其是在端半部），产卵瓣端部不向内弯曲，而缘毛果蝇雌成虫产卵器宽得多，产卵瓣端部显著向内弯曲。

正模 ♂，云南昆明筇竹寺，2006-08-22，户田正宪、高建军采。副模：7 ♂♂，6 ♀♀，同正模；3 ♂♂，3 ♀♀，2006-08-20，其余同正模；1 ♀，2007-09-16，高建军采，其余同正模。

词源：新种以中科院院士、昆明动物研究所张亚平研究员之名命名，以感谢张先生对作者在果蝇分类及系统进化研究方面的支持。

**关键词** 缘毛果蝇种复合，新种，黄花凤仙花，云南，中国。  
**中图分类号** Q969.462.2